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Home Tanning

OF LEATHER
AND SMALL
FUR SKINS



FARMERS' BULLETIN
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U.S. DEPARTMENT OF AGRICULTURE

ORDINARILY hides and skins should be tanned only by experienced tanners. Sometimes and in some places, however, the spread between the receipts for hides and the cost of leather warrants the farmer in tanning for himself.

The inexperienced cannot hope to make leather equal in appearance, or possibly in quality, to that obtainable on the market, but farmers and ranchmen should be able to make serviceable leather for most farm purposes by carefully following the directions here given.

It is never advisable for an inexperienced person to try to tan valuable fur skins or large hides to be made into coats, robes, or rugs. The results would be disappointing, both in appearance and in quality. Small fur skins or skins of low market value, however, can be tanned for home or country use according to the directions given in this bulletin.

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HOME TANNING OF LEATHER AND SMALL FUR SKINS

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Contents

	Page		Page
Having hides tanned.....	1	Tanning hides and skins for leather—Contin-	
Buying leather by the side.....	2	ued.....	
Home tanning.....	3	Chrome-tanned leather.....	13
Tanning hides and skins for leather.....	3	Alum-tanned lace leather.....	18
Preliminary operations.....	5	Tanning fur skins.....	19
Bark-tanned sole and harness leather.....	9		

THE TANNING of a few hides and skins by inexperienced persons or by those lacking proper equipment is usually inadvisable, from the standpoint both of national economy and of individual profit. Tanners are equipped to make all the leather that the country needs. They can make leather of a better quality and can do it more economically than can the farmer. Under normal conditions, then, farmers and ranchmen should try to improve the quality of the hides and skins that they produce and to market them advantageously, leaving to tanners those trade operations which call for time and equipment and which often result in loss of hides and labor when undertaken by those who have had no experience in the work.

HAVING HIDES TANNED

It may be more economical to have hides and skins tanned by tanners who are willing to tan one or more hides than to do the work on the farm or ranch. Some tanners tan only hides with the hair on for robes or coats; some also tan harness, strap, lace, and glove leather; others tan only harness, strap, or lace leather; and a few tan sole leather. Some accept one-half of the hide in payment for tanning the other half. That is, if a farmer sends a hide to be tanned, the tanner will send back one-half tanned into leather and keep the other half to pay for his work. This probably is the best way for farmers to get their leather.

Depending on the size of the hide, the kind of leather, and the tanner's prices and profits, the charge for tanning a hide with the hair on or making it into leather varies from \$1.50 to \$4 for calfskins, and from \$5 to \$8 a hide, or from 25 to 50 cents a square foot or a pound, for horse and cattle hides tanned into harness, lace, or glove leather.

¹ In July 1940 the authors, with the exception of F. P. Veitch (who retired May 31, 1938), and the work on which this publication is based were transferred to the Eastern Regional Research Laboratory, Philadelphia 18, Pa., Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture.

Definite prices can be obtained directly only from a tanner. In writing to tanners be sure to state exactly what kind of hides you have. Give the weight of each, and ask for prices for tanning them with the hair on, making them into robes or coats, or tanning them into the kind of leather you want. The hide you have may not be suitable for the kind of leather you want. It takes a 50-pound or heavier hide to make sole or harness leather. If you tell the tanner what you have, he can tell you what it will make. A list of tanners who tan leather and furs for farmers may be obtained by writing to the Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, Chestnut Hill Station, Philadelphia 18, Pa. In supplying this list of names and addresses the Department assumes no responsibility for the reliability or quality of work of these tanners. The list simply gives the names of all who have informed the Bureau that they will tan one or more hides for farmers.

As a rule, the tanner does not pay shipping charges either way. These, in addition to the tanning charge, must be paid by the farmer.

The regulations for shipping hides by express are now very stringent. Express companies will not accept hides for shipment unless they are packed in a keg or other container that does not leak. Consult the nearest express agent about this before shipping.

Be sure to tag each hide securely before it is shipped with your name and address and the kind of leather you wish made from it. Use a tough linen tag with a reinforced eyelet, and write plainly with indelible pencil. If tag comes off you probably will lose the hide.

BUYING LEATHER BY THE SIDE

Many farmers state that they are offered only 1 to 4 cents a pound for hides but are charged from 90 cents to \$1.50 a pound for leather at retail. It may prove more economical in many cases to buy, either individually or cooperatively, leather in quantities larger than a pound or two.

In December 1945, wholesale prices for leather given in trade journals were about as follows: Sole leather crops, 41 to 43 cents a pound; sole leather bends, 43 to 46 cents a pound; sole leather bellies, 25 to 27 cents a pound; single shoulders, 38 to 42 cents, and rough double shoulders, 45 to 48 cents a pound; harness leather sides, 36 to 44 cents a pound, and latigo sides, 35 to 38 cents a square foot; side upper leather, chrome tanned, 26 to 32 cents a square foot. Leather made from packer hides usually sells for more than that made from country hides. Wholesale prices fluctuate from time to time. Definite information on prices at the time of purchase must be obtained from dealers or tanners.

By buying a single side of leather as he needs it, a farmer should be able to get it at a price not more than 10 to 20 percent above wholesale quotations. Expressage on leather bought from tanners must of course, be paid by the purchaser. If whole sides cannot be obtained from dealers in nearby cities or towns at satisfactory prices, write the tanners for their prices.

Sole leather is principally vegetable tanned or chrome tanned and is classed as heavy, medium, and light. For quality it is graded No. 1, No. 2, and No. 3. Chrome sole leather can be bought waxed or unwaxed. Only the waxed is suitable for outdoor use. Harness leather is heavy, medium, and light, and for quality it is graded No. 1 and No. 2, or A and B.

A "side" of leather is half of a tanned hide. It weighs from 15 to 30 pounds, depending upon the size of the hide and the kind of leather. A "back" is a side of leather with the belly, legs, and head trimmed off. Backs cost a little more (3 to 6 cents a pound) than sides. A "bend" is a side of leather with the belly, legs, and shoulder trimmed off. It is the best leather of the hide and is approximately one-half the area or weight of the side. Bends cost more than either backs or sides.

A comparison of the prices at which leather can be bought with the charges for having hides tanned will show which is cheaper. As a general rule, it is believed that it is cheaper to have hides tanned one-half for the other.

HOME TANNING

Sometimes hides and skins can be sold by a farmer or rancher only at prices which are lower than the cost of production. Sometimes "country" hides can scarcely be given away, yet farmers must pay from \$1 to \$1.50 a pound for leather in small pieces. Under such conditions farmers naturally feel that they must either work up their raw materials or do without the finished leather. As a result, the United States Department of Agriculture has received thousands of requests for directions for farm or home tanning. To meet this demand the following directions have been prepared for tanning one or more hides or skins with only the equipment that can be had on any farm or ranch.

Although good results have been obtained in this Bureau by using the equipment and following the directions here given, inexperienced operators probably often will be unsuccessful. Every attempt, however, will add to their experience and should reduce the number of their failures. Operating on a small scale, they cannot hope to make leather equal in appearance, and possibly in quality, to that on the market. They should, however, be able to make leather which is serviceable for many purposes on farms and ranches.

The directions for tanning need not be memorized, but they must be studied carefully until thoroughly understood before the work is begun. All supplies and equipment should be on hand and all plans should be carefully made before the work is started. It may be necessary to modify the directions, especially those dealing with equipment or tanning conditions. Success in modifying them depends largely upon the individual.

Tanning operations are done best at a uniformly moderate temperature. A cellar, which is naturally fairly warm in winter and cool in summer, is a suitable place. A supply of fresh water near at hand and a drain are convenient.

All the operations can be done in tight, clean wooden barrels, preferably oak, having a capacity of from 40 to 60 gallons. When not in use the barrels should be kept clean and full of water. Half barrels and wooden or fiber buckets are useful for many purposes. Iron containers should never be used. Tools useful in tanning are shown in figure 1.

TANNING HIDES AND SKINS FOR LEATHER

The kind of leather which can be made from a hide or skin depends largely upon the weight and size of the hide or skin. In the tanning trade distinctions in hides and skins are based mainly upon the size

and age of the animal and upon the class of leather. Hides from large and adult animals are suitable for sole, harness, belting, or heavy leathers. Skins from small animals, such as sheep, goats, calves, and deer, are made into light and fancy leathers. While there are other commercially important sources of hides and skins, the most important ones are the usual domesticated farm and range animals. As a general rule, the thickness of the finished leather will be about the same as that of the untanned hide. This should be a

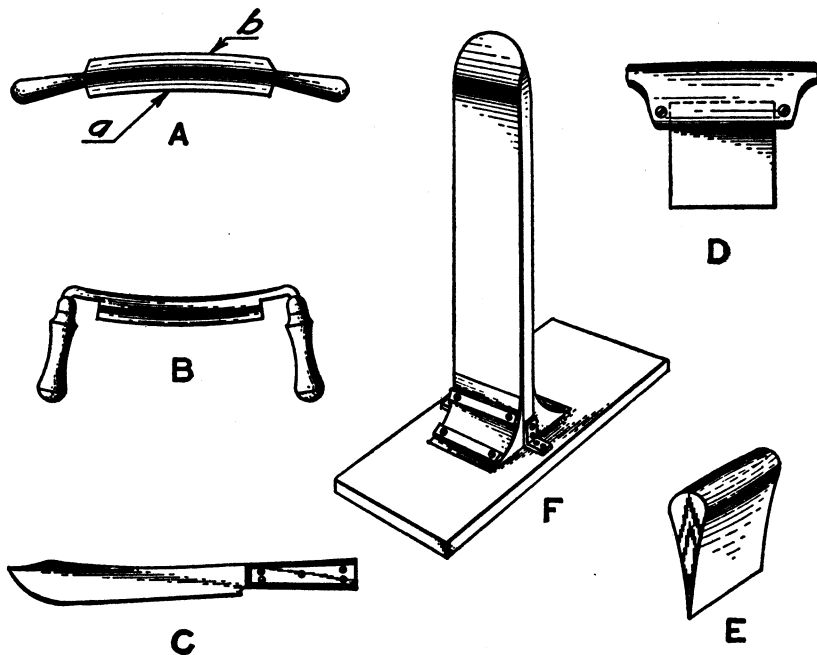


FIGURE 1.—Tools for tanning.

(A) Tanner's fleshing knife, having a blade 15 to 17 inches long: (a) Dull edge for scraping off the hair after liming; (b) very sharp edge for shaving off the flesh.

(B) Eight-inch-blade drawing knife, which may be used instead of A, especially if both handles are bent straight. The back edge may be used for unhairing and the cutting edge for shaving off the flesh.

(C) Twelve-inch-blade butcher knife, which may be used instead of A or B when the point has been driven into a wooden handle or wrapped with leather.

(D) Metal slicker—a dull steel blade about 5 inches square, $\frac{1}{2}$ to $\frac{1}{4}$ inch thick, mounted in a wooden handle.

(E) Wooden slicker, made of hardwood, about 6 inches square, $1\frac{1}{2}$ inches thick at head, shaved down in the shape of a wedge to a thin edge.

(F) Stake for breaking up and softening skins and leather. A board about 3 feet long, 6 inches wide, and 1 inch thick is braced in an upright position to a heavy base or to the floor. The top of the board is rounded and thinned in the shape of a wedge to an edge about $\frac{1}{8}$ inch thick.

guide in selecting skins for different kinds of leather. The first essential for a satisfactory yield of good leather is a sound, clean hide or skin. Skinning should be done properly, without cutting or scoring the hide, and at the same time all of the fat and flesh should be removed; for, if left on, they increase the tendency of the hide to rot or spoil. Farmers' Bulletin 1055, *Country Hides and Skins: Skinning, Curing, and Marketing*, should be studied in this connection.

Preparation of the hide or skin for tanning may be begun as soon as it has been taken off the animal, drained, and cooled from the body heat. Overnight will be long enough. If tanning is not to be started at once or if there are more hides than can be handled at one time, the hides may be thoroughly salted, using about 1 pound of clean salt for each pound of hide, and kept for from 3 to 5 months. The hides must never be allowed to freeze or heat during storage or tanning. Some tanners state that salting before tanning is helpful. It can do no harm to salt a hide for a few days before it is prepared for tanning.

The directions here given have been prepared for a single heavy cow, steer, or bull hide weighing from 40 to 70 pounds or for an equivalent weight in smaller skins, such as calf or kip skins. The heavy hides are best suited for sole, harness, or belting leather. Lighter hides weighing from 20 to 40 pounds should be used for lace leather.

PRELIMINARY OPERATIONS

Before it is tanned a hide or skin must be put through the following preliminary operations, which are the same for all the leather-making processes given in this bulletin. As soon as the hide or skin has been put through these processes, start the tanning, following the directions given for the particular kind of leather desired.

Slaking Lime

Put from 6 to 8 pounds of burnt or caustic lime in a clean half barrel, wooden tub, or bucket, with a capacity of at least 5 gallons. Use only good-quality lime, free from dirt and stones; never use air-slaked lime. To the lime add about 1 quart of water. As the lime begins to slake add more water, a little at a time, to keep the lime moist. Do not pour in enough water to quench the slaking. When the lime appears to be slaked, stir in 2 gallons of clean water. Do all this just as in making whitewash. Slake the lime on the day before the soaking of the hide is begun and keep the limewater covered with boards or sacks until ready to use it.

If available, fresh hydrated lime, not air-slaked, may be used instead of the burnt or caustic lime. In this case use from 8 to 10 pounds in 4 or 5 gallons of water.

Soaking and Cleaning

If the hide has been salted, shake it vigorously to remove most of the salt. Spread it out, hair side down, and trim off the tail, head, ears, all ragged edges, and shanks.

Place the hide, hair side up, lengthwise, over a smooth log or board, and with a sharp knife split it from neck to tail, straight down the backbone line, into two half hides, or "sides." It will be more convenient in the later handling, especially when the hide is large, to then split each side lengthwise through the "break," just above the flanks, into two strips, making the strip with the backbone edge about twice as wide as the belly strip. Thus a whole hide will give two sides or four strips. If desired, small skins need not be split. In these directions "side" means side, strip, or skin, as the case may be.

Fill a 50-gallon barrel with clean, cool water. Place the sides, flesh side out, over short sticks or pieces of rope and hang them in the barrel of water. Let them soak for 2 or 3 hours. Stir them about frequently to soften, loosen, and wash out the blood, dirt, ma-

nure, and salt. The sticks or pieces of rope may be held in place by tying a loop of cord on each end and catching the loops over nails in the outside of the barrel near the top.

After they have soaked for about 3 hours take out the sides, one at a time, and place them, hair side up, over a "beam." A ready-made beam can be bought. A fairly satisfactory one may be made from a very smooth slab, log, or thick planed board, from 1 to 2 feet wide and



FIGURE 2.—Putting a side into limewater. The hide has been split into two sides and soaked and cleaned. Each side is folded over a stick.

6 to 8 feet long. The slab or log is inclined, with one end resting on the ground and the other extending over a box or trestle so as to be about waist high. With the side lying hair side up over the beam, scrub off all dirt and manure, using if necessary a stiff brush. Wash off with several bucketfuls of clean water.

Turn the side over, flesh side up, and scrape or cut off any remaining flesh. Work over the entire flesh side with the back edge of a drawing or butcher knife held firmly against the hide, pushing away from the body. Wash off with one or two bucketfuls of clean water. This working over should always be done.

Refill the soak barrel with clean, cool water and hang the sides in it as before. Pull them up and stir them about frequently until they are soft and flexible. Usually a green or fresh hide needs to be soaked for not more than from 12 to 24 hours and a green salted hide for not more than from 24 to 48 hours.

When the sides are properly softened—that is, when they are about like a fresh hide or skin—throw them over the beam and thoroughly scrape off all remaining flesh and fat. It is of the greatest importance to remove all this material. When it cannot be scraped off, cut it off, but be careful not to cut into the hide itself. Even should there appear to be no flesh to take off and nothing seems to be removed,



FIGURE 3:—Ready to unhair after liming. When the hair can be rubbed off easily with the hand the hide is ready to be unhaird.

it is necessary to thoroughly work over the flesh side in this way with the back of a knife. Finally wash it off with a bucketful of clean water.

The side must be soft, pliable, and clean all over before being put into the lime, which is the next step.

Liming

Wash out the soak barrel, pour in all of the slaked lime, nearly fill the barrel with clean, cool water, and stir thoroughly. Again place the sides, hair side out, over the short sticks or pieces of rope, and hang them in the barrel so that they are completely covered by the limewater (fig. 2). See that the sides have as few folds or wrinkles as possible, and also be sure that no air is trapped under them. Keep the barrel covered with boards or bags. Pull up the sides and stir

the limewater three or four times each day until the hair will come off easily. This takes from 6 to 10 days in summer and possibly as many as 16 days in winter.

When thoroughly limed, the hair can be rubbed off readily with the hand (fig. 3). Early in the liming process it will be possible to pull out the hair, but the hide must be left in the limewater until the hair comes off by rubbing over with the hand. For harness and



FIGURE 4.—Unhairing. After thorough liming, the hair is pushed or scraped off with a dull metal edge. At the same time some of the lime, grease, and dirt are worked out of the hide. Here the workman is using the dull edge of the fleshing knife and a tanner's beam.

belting leathers leave the hide in the limewater for from 3 to 5 days after this condition has been reached

Unhairing

After the side has been limed, throw it hair side up, over the beam and with the back edge of a drawing or butcher knife held nearly flat against the side push off the hair from all parts (fig. 4). If the side is sufficiently limed, a curdy or cheesy layer of skin rubs off with the hair. If this layer does not rub off, the side must be returned to the limewater. Now thoroughly work over the grain or hair side with a dull-edged tool to "scud" or work out as much lime, grease, and dirt as possible.

Fleshing

Turn the side over and scud it again, being sure to remove all fleshy matter. Shave down to the hide itself, but be careful not to cut into it. Remove the flesh by scraping and by using a very sharp knife (fig. 1), with a motion like that of shaving the face (fig. 5).

Now proceed as directed under Bark-Tanned Sole and Harness Leather (p. 9), Chrome-Tanned Leather (p. 13), or Alum-Tanned Lace Leather (p. 18), depending upon the kind of leather desired.



FIGURE 5.—Fleshing. All flesh, fat, and tissue must be shaved off down to the real hide or skin.

Wastes from Liming

The lime, limewater, sludge, and fleshings from the liming process may be used as fertilizer, particularly for acid soils. The hair, as it is scraped from the hide, may be collected separately and after being rinsed several times may be used in plastering. If desired, it can be thoroughly washed with many changes of water until absolutely clean and after being dried out in a warm place used for padding, upholstering, insulation of pipes, etc.

BARK-TANNED SOLE AND HARNESS LEATHER

Deliming

After the sides have been put through the unhairing and fleshing operations, rinse them with clean water. Wash the sides in cool, clean water for from 6 to 8 hours, changing the water frequently.

Buy 5 ounces of U. S. P. (United States Pharmacopœia) lactic acid (or 16 ounces of tannery 22 percent lactic acid). Nearly fill a clean 40- to 50-gallon barrel with clean, cool water, stir in the lactic acid, and mix the water and acid thoroughly with a paddle. Hang the sides in the barrel and leave them there for 24 hours, pulling them up and stirring them frequently.

Take out the sides, work over or scud them thoroughly, as directed under Unhairing (p. 8), and hang them in a barrel of cold water.



FIGURE 6.—Unhaired, fleshed hide ready to be delimed. All hair, flesh, and fat must be removed, as well as much of the lime and grease.

Change the water several times, and finally leave them in the water overnight.

If lactic acid cannot be obtained, use a gallon of vinegar instead.

Tanning

The sides are now ready for the actual tanning. From 15 to 20 days before this stage will be reached, weigh out from 30 to 40 pounds of good quality, finely ground oak or hemlock bark and pour onto it about 20 gallons of boiling water.

Finely ground bark, with no particles larger than a grain of corn, will give the best results. Simply chopping the bark into coarse pieces will not do. Do not let the tan liquor come in contact with iron vessels. Use the purest water available. Rain water is best.

Let this bark infusion stand in a covered vessel until ready to use it. Stir it occasionally. When ready to start tanning, strain off the bark liquor through a clean, coarse sack into the tanning barrel. Fill the barrel about three-quarters full with water, rinsing the bark with this water so as to get out as much tannin as possible. Add 2 quarts of vinegar. Stir well. Place the sides, from the deliming, over sticks, and hang them in this bark liquor with as few folds and wrinkles as possible. Move the sides about and change their position often in order to get an even color.

Just as soon as the sides have been hung in the bark liquor, again soak from 30 to 40 pounds of ground bark in about 20 gallons of hot water. Let this second bark liquor stand until the sides have become evenly colored, or for from 10 to 15 days. Take out of the tanning barrel 5 gallons of liquor and pour in about one-quarter of the second bark liquor. Also add about 2 quarts more of vinegar and stir it in well. Five days later take out a second 5 gallons of tanning liquor from the barrel and add another fourth of the tan liquor only (no vinegar). Do this every 5 days until the second bark liquor is used up.

The progress of the tanning varies somewhat with conditions and can best be followed by inspecting a small sliver cut from the edge of the hide. About 35 days after the actual tanning has been started a fresh cut should show two dark or brown narrow streaks about as wide as a heavy pencil line coming in from each surface of the hide.

At this stage weigh out about 40 pounds of fine bark and just moisten it with hot water. Do not add more water than the bark will soak up. Pull the sides out of the bark liquor and dump in the moistened bark, keeping in the barrel as much of the old tan liquor as possible. Mix thoroughly and while mixing hang the sides back in the barrel. Actually bury them in the bark. All parts of the sides must be kept well down in the bark mixture. Leave the sides in this bark for about 6 weeks and move them about once in a while.

At the end of 6 weeks pull the sides out. A cutting should show that the tanning has spread nearer to the center. Pour out about half the liquor. Stir the bark in the barrel, hang the sides back, and fill the barrel with fresh, finely ground bark. Leave the sides in for about 2 months, shaking the barrel from time to time and adding bark and water as needed to keep the sides completely covered.

At the end of this time the hide should be evenly colored all the way through, without any white or raw streak in the center of a cut edge. If it is not struck through, it must be left longer in the wet bark, and more bark may be needed.

For harness, strap, and belting leather the sides may be taken out of the bark liquor at this stage, but for sole leather they must be left for 2 months longer. When fully tanned through, the sides are ready for oiling and finishing.

Oiling and Finishing

HARNESS AND BELTING LEATHER.—Take the sides from the tan liquor, rinse them off with water, and scour the grain or hair side thoroughly with plenty of warm water and a stiff brush. Then go over the sides with a "slicker" (fig. 1), pressing the slicker firmly against

the leather while pushing it away from the body and work out as much water as possible. "Slick" out on the grain or hair side in all directions (fig. 7). For harness, belting, and the like this scouring and slicking must be done thoroughly.

A slicker can be made from a piece of copper or brass about one-fourth inch thick, 6 inches long, and 4 inches wide. One long edge of the slicker is mounted in a wooden handle and the other long edge is finished smooth and well rounded. A piece of hardwood, about 6 inches square, 1½ inches thick at the head, and shaved down wedge-shape to a thin edge will also serve as a slicker (fig. 1).



FIGURE 7.—Slicking out. After tanning and after greasing, the leather should be worked out on both sides with a slicker.

While the sides are still damp, but not very wet, go over the grain or hair side with a liberal coating of neat's-foot or cod oil. Hang up the sides and let them dry out slowly. When dry, take them down and dampen well by dipping in water or by rolling them up in wet sacking or burlap.

When uniformly damp and limber, evenly brush or mop over the grain or hair side a thick coating of warm dubbin. The dubbin is made by melting together about equal parts of cod oil and tallow or neat's-foot oil and tallow. This dubbin when cool must be soft and pasty, but not liquid.

Hang up the sides again and leave until thoroughly dry. When dry, scrape off the excess tallow by working over with the slicker. If more grease in the leather is desired, dampen again and apply another coating of the dubbin, giving a light application to the flesh

side also. When again dry, remove the tallow and thoroughly work over all parts of the leather with the slicker. Rubbing over with sawdust will help to take up any surface oiliness.

If it is desired to blacken the leather, this must be done before greasing. A black dye solution can be made by dissolving one-half ounce of water-soluble nigrosine in $1\frac{1}{4}$ pints of water, with the addition, if handy, of several drops of ammonia. Evenly mop or brush this solution over the dampened but ungreased leather and then grease as directed in the preceding paragraph.

SOLE LEATHER.—Take the sides from the tan liquor and rinse them thoroughly with clean water. Hang them up until they are only damp and then apply a good coating of neat's-foot or cod oil to the grain or hair side. Again hang them up until they are thoroughly dry.

When repairing shoes with this leather it is advisable, after cutting out the piece for soling, to dampen and hammer it down well, and then, after putting it on the shoe, to make it waterproof and more serviceable by setting the shoe in a shallow pan of melted grease or oil and letting it stand for about 15 minutes. The grease or oil must be no hotter than the hand can bear. Rubber heels should not be put in oil or grease. The soles of shoes with rubber heels may be waterproofed in the same way, using a piepan for the oil or grease and placing the heels outside the pan. Any good oil or grease will do. The following formulas have been found satisfactory:

Formula 1:	Ounces
Neutral wool grease.....	8
Dark petrolatum.....	4
Paraffin wax.....	4
Formula 2:	
Petrolatum.....	16
Beeswax.....	2
Formula 3:	
Petrolatum.....	8
Paraffin wax.....	4
Wool grease.....	4
Crude turpentine gum (gum thus).....	2
Formula 4:	
Tallow.....	12
Cod oil.....	4

CHROME-TANNED LEATHER

For many purposes chrome-tanned leather is considered to be as good as the more generally known bark or vegetable-tanned leather. The chrome process, which takes only a few weeks as against as many months for the bark-tanning process, derives its name from the use of chemicals containing chromium or "chrome." It is a chemical process requiring great care. It is felt, however, that by following exactly the directions here given, never disregarding details which may seem unimportant, a serviceable leather can be produced in a comparatively short time. The saving in time seems sufficient to justify a trial of this process.

Deliming

After the sides have been put through the unhairing and fleshing operations (pp. 8 and 9) rinse them off with clean water.

If sole, belting, or harness leather is to be tanned, soak and wash the sides in cool water for about 6 hours before putting them into the lactic acid. Change the water four or five times.

If strap, upper, or thin leather is to be tanned, put the limed white sides into a wooden or fiber tub of clean, lukewarm (about 90° F.) water and let them stay there for from 4 to 8 hours before putting them into the lactic acid. Stir the sides about occasionally. Be sure that the water is not too hot. It never should be so hot that it is uncomfortably warm to the hand.

For each large hide or skin buy 5 ounces of U. S. P. lactic acid (or 16 ounces of tannery 22 percent lactic acid). Nearly fill a clean 40- to 50-gallon barrel with clean, cool water, and stir in the lactic acid, mixing thoroughly with a paddle. Hang the sides in the barrel, and leave them there for 24 hours, plunging them up and down occasionally.

For light skins, weighing less than 15 pounds, use only 2 ounces of U. S. P. lactic acid in about 20 gallons of water.

If lactic acid cannot be obtained, use 1 pint of vinegar for every ounce of lactic acid. An effort should be made to get the lactic acid, however, for vinegar will not be as satisfactory, especially for the medium and smaller skins.

After deliming, work over both sides of the side as directed under Unhairing (p. 8).

For sole, belting, and harness leathers, hang the sides in a barrel of cool water overnight. Then proceed as directed under Tanning.

For thin, softer leathers from small skins, do not soak the sides in water overnight. Simply rinse them off with water and proceed as directed under Tanning.

Tanning

The tanning solution should be made up at least 2 days before it is to be used—that is, not later than when the sides are taken from the limewater for the last time.

Remember that this is a chemical process and that all materials must be of good quality and accurately weighed and the specified quantities of water carefully measured.

The following chemicals are required: Chrome alum (chromium potassium sulfate crystals); soda crystals (crystallized sodium carbonate); and common salt (sodium chloride). Insist upon pure chemicals of the United States Pharmacopœia quality. Get them from the nearest drugstore or find out from it the address of a chemical manufacturing concern which can supply them.

For each hide or skin weighing more than 30 pounds use the following quantities for the stock chrome solution:

Dissolve 3½ pounds of soda crystals (crystallized sodium carbonate) and 6 pounds of common salt (sodium chloride) in 3 gallons of warm, clean water in a wooden or fiber bucket. The soda crystals must be clear or glasslike. Do not use the white crusted lumps.

At the same time dissolve in a large tub or half barrel 12 pounds of chrome alum (chromium potassium sulfate crystals) in 9 gallons of cool, clean water. This will take some time to dissolve and will need frequent stirring. Here again it is important to use only the very dark, hard, glossy, purple or plum-colored crystals of chrome alum, not the lighter, crumbly, dull-lavender ones.

When the chemicals are dissolved, which can be told by feeling around in the tubs with a paddle, pour the soda-salt solution slowly

in a thin stream into the chrome-alum solution, stirring constantly. Take at least 10 minutes to pour in the soda solution. This should give one solution of about 12 gallons, which is the stock chrome solution. Keep this solution well covered in a wooden or fiber bucket, tub, or half barrel.

To start tanning, pour one-third (4 gallons) of the stock chrome solution into a clean 50-gallon barrel and add about 30 gallons of clean, cool water; that is, fill the barrel about two-thirds full. Thoroughly mix the solution in the barrel and hang in it the sides from the deliming. Work the sides about and stir the solution frequently, especially during the first 2 or 3 days. This helps to give the sides an even color. It should be done every hour or so throughout the first day. Keep the sides as smooth as possible.

After 3 days, temporarily remove the sides from the barrel. Add one-half of the remaining stock chrome solution, thoroughly mixing it with that in the barrel, and again hang in the sides. Move the sides about and stir the solution 3 or 4 times each day.

Three days later, once more temporarily remove the sides. Pour into the barrel the rest of the stock chrome solution, thoroughly mixing it with that in the barrel, and again hang in the sides. Move the sides about and stir frequently as before.

After the sides have been in this solution for 3 or 4 days, cut off a small piece of the thickest part of the side, usually in the neck, and examine the freshly cut edge of the piece. If the cut edge seems to be evenly colored greenish or bluish all the way through, the tanning is about finished. Boil the small piece in water for a few minutes. If it curls up and becomes hard or rubbery, the tanning is not completed and the sides must be left in the tanning solution for a few days longer, or until a small piece when boiled in water is changed little if at all.

The foregoing quantities and directions have been given for a medium or large hide. For smaller hides and skins the quantities of chemicals and water can be reduced. For each hide or skin weighing less than 30 pounds, or for two or three small skins together weighing not more than 30 pounds, the quantities of chemicals may be cut in half, giving the following solutions:

For the soda-salt solution, dissolve $1\frac{1}{4}$ pounds of soda crystals (crystallized sodium carbonate) and 3 pounds of common salt (sodium chloride) in $1\frac{1}{2}$ gallons of clean water.

For the chrome-alum solution, dissolve 6 pounds of chrome alum (chromium potassium sulfate crystals) in $4\frac{1}{2}$ gallons of cool, clean water.

When the chemicals are dissolved pour the soda-salt solution slowly into the chrome-alum solution as already described. This will give one solution of about 6 gallons which is the stock chrome solution. For the lighter skins tan with this solution, exactly as directed for medium and large hides, adding one-third, that is, 2 gallons, of this stock chrome solution each time, and begin to tan in about 15 gallons instead of 30 gallons of water. Follow the directions already given as to stirring, number of days, and testing to determine when tanning is completed. Very small, thin skins probably will not take as long to tan as will the large hides. The boiling-water test is very reliable for showing when the hide is tanned.

Washing and Neutralizing

When the sides are tanned, take them out of the tanning solution and put them in a barrel of clean water. The barrel in which the tanning was done can be used after it has been thoroughly washed.

When emptying the tanning barrel be sure carefully to dispose of the tanning solution. Although not poisonous to the touch, it probably would be fatal to farm animals should they drink it, and it is harmful to soil.

Wash the sides in about four changes of water. For medium and large hides, dissolve 2 pounds of borax in about 40 gallons of clean water and soak the sides in this solution overnight. For hides and skins weighing less than 25 pounds, use 1 pound of borax in about 20 gallons of water. Move the sides about in the borax solution as often as feasible. After soaking overnight in the borax solution, remove the sides and wash them for an entire day, changing the water five or six times. Take the sides out, let the water drain off, and proceed as directed under Dyeing Black, or, if it is not desired to blacken the leather, proceed as directed under Oiling and Finishing.

Dyeing Black

WATER-SOLUBLE NIGROSINE.—One of the simplest and best means of dyeing leather black is to use nigrosine. Make up the dye solution in the proportion of one-half ounce of water-soluble nigrosine dissolved in $1\frac{1}{4}$ pints of water. Be sure to get water-soluble nigrosine. Evenly mop or brush this solution over the damp leather after draining as already directed and then proceed as directed under Oiling and Finishing.

IRON LIQUOR AND SUMAC.—If water-soluble nigrosine cannot be obtained, a fairly good black may be secured with iron liquor and sumac. To make the iron liquor, mix clean iron filings or turnings with one-half gallon of good vinegar and let the mixture stand for several days. See that there are always some undissolved filings or turnings in the vinegar. For a medium or large hide put from 10 to 15 pounds of dried crumbled sumac leaves in a barrel containing from 35 to 40 gallons of warm water. Stir well and when cool hang in it the wet, chrome-tanned sides. Leave the sides in this solution for about 2 days, pulling them up and mixing the solution frequently. Take out the sides, rinse off all bits of sumac, and evenly mop or brush over with the iron liquor. Rinse off the excess of iron liquor and put the sides back in the sumac overnight. If not black enough the next morning, mop over again with iron liquor, rinse, and return to the sumac solution for a day. Take the sides out of the sumac, rinse well, and scrub thoroughly with warm water. Finally wash the sides for a few hours in several changes of water.

While both of these formulas for dyeing have been given, it is recommended that water-soluble nigrosine be used whenever possible, as the iron liquor and sumac formula is somewhat troublesome and may produce a cracky grain. After blackening, proceed as directed under Oiling and Finishing.

Oiling and Finishing

THIN LEATHER.—Let the wet tanned leather from the dyeing, or, if not dyed, from the neutralizing, dry out slowly. While it is still very damp go over the grain or hair side with a liberal coating of

neat's-foot or cod oil. While still damp, tack the sides out on a wall or tie them in frames (shown on cover), being sure to pull them out tight and smooth, and leave them until dry. When dry take down and dampen well by dipping in warm water or by rolling them up in wet sacking or burlap. When uniformly damp and limber go over the sides with a "slicker" (fig. 1), pressing the slicker firmly against



FIGURE 8.—Staking. To soften leather and tanned skins, work them repeatedly back and forth in all directions over a dull edge. This must be done when the leather is drying.

the leather, while pushing it away from the body. Slick out on the grain or hair side in all directions (fig. 7).

After slicking it may be necessary to "stake" the leather (fig. 8). This is done by pulling the damp leather vigorously back and forth over the edge of a small smooth board about 3 feet long, 6 inches wide, and 1 inch thick, fastened upright and braced to the floor or ground. The top end of the board must be shaved down to a wedge shape, with the edge not more than one-eighth-inch thick and the corners well-rounded (fig. 1). Pull the sides, flesh side down, backward and forward over this edge, exactly as a cloth is worked back and forth in polishing shoes.

Let the sides dry out thoroughly again. If not sufficiently soft and pliable, dampen them with water, apply more oil, and slick and stake as before. The more time given to slicking and staking, the smoother and more pliable the leather will be.

THICK LEATHER.—Thick leather from the larger hides is oiled and finished in a slightly different manner. For harness and strap leather, let the tanned sides, dyed if desired, dry down. While they are still quite damp slick over the grain or hair side thoroughly and apply a liberal coating of neat's-foot or cod oil. Tack on a wall or tie in a frame, stretching the leather out tight and smooth, and leave until dry. Take the sides down, dampen them with warm water until limber and pliable, and apply to the grain side a thick coating of warm dubbin. The dubbin is made by melting together about equal parts of cod oil and tallow or neat's-foot oil and tallow. When cool it must be soft and pasty but not liquid. If too nearly liquid, add more tallow. Hang up the sides again and leave them until thoroughly dried. When dry, scrape off the excess tallow by working over with the slicker. If more grease in the leather is desired, dampen again and apply another coating of the dubbin. When again dry, slick off the tallow and thoroughly work over all parts of the leather with the slicker. Rubbing over with sawdust helps to take up surface oiliness.

Chrome-tanned leather is stretchy, so that in cutting the leather for use in harness, straps, reins, and similar articles it is best to first take out most of the stretch.

Chrome leather for shoe soles must be heavily greased, or, in other words, waterproofed, unless it is to be worn in extremely dry regions. Waterproofing may be done after repairing the shoes by setting them in a shallow pan of oil or grease so that just the soles are covered by the grease. The soles should be dry before they are set in the melted grease. Melted paraffin wax will do, although it makes the soles stiff. The simple formulas given on page 13 are satisfactory for waterproofing chrome sole leather.

ALUM-TANNED LACE LEATHER

Deliming

After the sides have been put through the unhairing and fleshing operations (pp. 8 and 9), rinse them off with cool, clean water for from 6 to 8 hours, changing the water frequently.

Buy 5 ounces of U. S. P. lactic acid (or 16 ounces of tannery 22 percent lactic acid). Nearly fill a clean 40- to 50-gallon barrel with clean, cool water and stir in the lactic acid, mixing thoroughly with a paddle. Hang the sides in the barrel and leave them there for 24 hours, pulling them up and stirring them about frequently. Take out the sides, work over or scud thoroughly, as directed under Unhairing (p. 8), and hang them in a barrel of cool water. Change the water several times, and finally leave them in the water overnight. If lactic acid cannot be obtained, use a gallon of vinegar instead.

Tanning

While the sides are being delimed, thoroughly wash out the barrel in which the hide was limed. Put in it 15 gallons of clean water and 12 pounds of ammonia alum or potash alum and stir frequently until it is completely dissolved.

Dissolve 3 pounds of washing soda (crystallized sodium carbonate) and 6 pounds of salt in 5 gallons of cold, clean water in a wooden bucket. The soda crystals must be clear and glasslike. Do not use white crusted lumps.

Pour the soda solution into the alum solution in the barrel very, very slowly, stirring the solution in the barrel constantly. Take at least 10 minutes to pour in the soda solution in a small stream. If the soda is poured in rapidly the solution will become milky and will not tan. The solution should be cool, and enough water to nearly fill the barrel should be added.

Hang each well-washed side from the deliming in the alum-soda solution. Pull up the sides and stir the solution six or eight times each day. Do not put the bare hands in the liquor if they are cut or cracked or have sores on them.

After 6 or 7 days remove the sides from the alum-soda solution and rinse well for about a quarter of an hour in clean, cold water.

Oiling and Finishing

Let the sides drain and dry out slowly. While still very damp go over the grain or hair side with a liberal coating of neat's-foot or cod oil. After the oil has gone in and the sides have dried a little more but are still slightly damp, begin to work them over a "stake." The time to start staking is important. The sides must not be too damp; neither must they be too dry. When light spots or light streaks appear on folding it is time to begin staking. Alum-tanned leather must be thoroughly and frequently staked.

Staking is done by pulling the damp leather vigorously back and forth over the edge of a small, smooth board (fig. 1), as described on page 17. The sides must be staked thoroughly all over in order to make them pliable and soft, and the staking must be continued at intervals until the leather is dry.

When dry, evenly dampen the sides by dipping them in water or by leaving them overnight covered with wet burlap or sacks. Apply to the grain or hair side a thick coating of warm dubbin. The dubbin is made by melting together about equal parts of neat's-foot oil and tallow or cod oil and tallow. When cool, the dubbin must be soft and pasty but not liquid. If too nearly liquid, add more tallow. Leave the greased sides, preferably in a warm place, until dry. Scrape off the excess tallow and again stake the sides. If the leather is too hard and stiff, dampen it evenly with water before staking.

After staking, go over the sides with a slicker (fig. 1), pressing the slicker firmly against the leather, while pushing it away from the body. Slick out on the grain, or hair side, in all directions (fig. 7).

Alum-tanned leather almost invariably dries out the first time hard and stiff. It must be dampened again and restaked while drying. In some cases this must be done repeatedly, and another application of dubbin may be necessary. By repeated dampening, staking, and slicking the leather can be made as soft and pliable as desired.

TANNING FUR SKINS

Much of the value of a fur skin depends upon the manner in which it is handled in the raw state. After the animal has been caught, every effort should be made to follow the best practices in skinning

and curing, in order to obtain a skin of the greatest possible value. Certain trade customs also must be followed to secure the top price. Detailed information on the manner of skinning and curing skins from the better known fur-bearing animals is given in United States Department of Agriculture Yearbook Separate 823, Trapping on the Farm, which may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy.

Requests for directions for tanning fur skins are constantly received by the Department of Agriculture. There is, however, less need for such information than there is for information on farm or

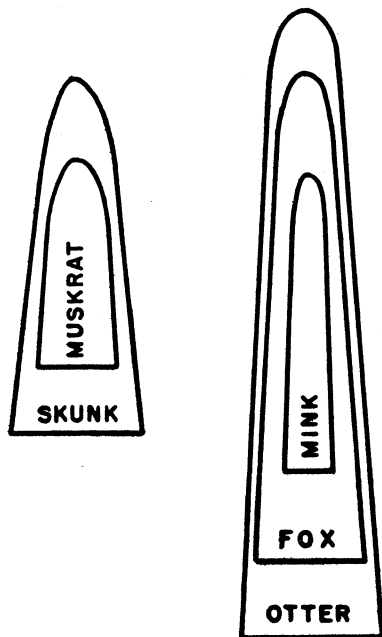


FIGURE 9.—Stretching boards for fur skins. Cased fur skins are dried on boards of different sizes and shapes, depending upon the kind of skin.

home tanning of hides and skins into leather. Fur skins as a protection are a necessity for those living in cold climates, but comparatively few are used for this purpose. Most of the fur skins are made into articles which are more or less of a luxury and, as such, are valued largely on the basis of their appearance and finish, which an inexperienced worker can seldom make sufficiently pleasing. Furthermore, raw fur skins are valuable, and, if well cared for, usually find a ready market. Nevertheless, the spread between the prices paid for raw furs and those demanded for finished fur articles is enormous. No doubt, this spread in many instances inspires the attempts at home manufacture.

An inexperienced person should not try to tan valuable fur skins or large hides, such as cattle, horse, or bear, for making into coats, robes, or rugs. The risk of damage or of an unsatisfactory product, as measured by the usual standards of finish and appearance, is too great. The difficulties in properly handling large hides make the

chances of success remote, except by those having suitable equipment and experience. Moreover, tanning the skin is only one step in the production of the finished article. After being tanned, all skins must be tailored, many must be dyed, and small ones must be matched, blended, and sewed together. All these operations require experience and practice to secure the attractive appearance desired by wearers of furs. Some of the operations, such as those of bleaching and dyeing, are so highly specialized that their undertaking should not even be considered by an amateur. From the standpoint of serviceability and usefulness, inexperienced persons might meet with a fair degree of success in tanning and tailoring fur skins, but few can ever hope to make a fur piece or garment which will compare favorably in appearance with the shop or factory product. The tanning and dressing of fur skins, then, are best left to those who are experienced and equipped to carry out the tedious operations required.

To satisfy the demand upon the Department for information on the home tanning of fur skins and to provide those who insist upon carrying on such work with correct information and with detailed methods which offer the best chances for success, the following directions are given. These directions are meant primarily for small fur skins no larger than that of the fox and for skins of low market value.

No formulas for tanning are foolproof, and success can be attained only by close observation, plenty of work, and the exercise of care and patience. All skins are not treated just alike. In fact, each skin has its own peculiarities, which only experience can show how to treat. Some skins are tough and fairly thick and will stand mistreatment; others are very thin and tender and are easily ruined. Some are fat and greasy and require thorough working out of the grease; others do not. An inexperienced person should experiment with the least valuable skins. If a number of skins of the same kind are to be tanned, one or two of the poorest should be tried first.

SOAKING AND FLESHING

The first step is to get the skin thoroughly softened, cleaned, and free from flesh and grease.

Split the tail the entire length on the underside. If the skin is "cased," split it neatly down the middle of the belly. Soak it in several changes of clear, cool water. When the skin begins to soften, lay it on a beam or smooth pole and begin working over the flesh side to break up the adhering tissue and fat. All dried skins have a shiny, tight layer of tissue. This tissue must be broken up and entirely removed, which is best done by repeated alternate working and soaking. A good tool for scratching the tissue is a metal edge of any kind, such as a drawing knife or an ordinary knife with dull saw teeth or notches filed in it. Working over with these dull teeth scratches or breaks up the tissue so that it can be scraped off after further soaking.

At the same time the grease and oil are worked out of the skin. This operation is of the utmost importance. It is utterly useless to start tanning until all the tissue and grease have been removed and the skin is uniformly soft and pliable, without any hard spots.

The time of soaking depends upon the condition of the skin. Some skins require only about 2 hours, while others need a much longer

time. Very hard skins often must be thoroughly dampened, rolled up, fur side out, and put away in a cool place overnight to soften. While a skin must be soaked until soft, it should not stay wet longer than necessary, as the hair may start to slip.

In fleshing and scraping, care also must be taken not to injure the true skin or expose the hair roots, especially on thin skins.

When the soaking is well advanced and the skin is getting in good shape, work it in lukewarm water containing an ounce of soda or borax to the gallon. Soap also may be added. This treatment promotes softening, cleans the skin, and cuts the grease.

Work again over the beam and finally rinse thoroughly in lukewarm water. Squeeze out most of the water, but do not wring the skin. Without further drying, work the skin in gasoline, using several changes if very much dirt and grease are present. Squeeze and hang up the skin for a few minutes.

The skin should now be ready for tanning. When painting or pasting of the tan liquor on the flesh side only is included in the directions for tanning, it is best to dry out the hair or fur side first by working in sawdust. In this way any heating of the fur side while the skin is tacked out is avoided, as are also matting and stiffening of the fur. If while drying out the fur, the flesh side becomes too dry, it must be evenly dampened with a wet cloth before applying the tan liquor.

COMBINATION TANNAGE

A combination tannage is a combination of mineral and vegetable tanning. It has an advantage over the salt-acid or salt-alum processes in giving a soft and flexible skin, as well as a more lasting tannage.

One of the most popular and successful formulas for a combination tannage is given by M. C. Lamb.² A pasty mixture of alum, salt, gambier, and flour, with or without glycerin or olive oil, is made as follows: Dissolve 1 pound of aluminium sulfate and 1 pound of salt together in a small quantity of water. Dissolve 3 ounces of gambier or Terra Japonica in a little boiling water. Mix the two solutions and make up to 2 gallons with water. As this solution is used, mix it with enough flour to make a moderately thin paste. If the skin has a hard texture and lacks natural grease, thoroughly mix a little olive oil or glycerin with the paste.

Soak, soften, and clean the skin as previously described and tack it out flat and smooth, flesh side up. Apply from two to three coatings of the paste, depending upon the thickness of the skin. Only thick skins require three coatings. Each coating should be about one-eighth inch thick and should be applied at intervals of a day. Between applications the skin should be kept covered with sacking or paper. Scrape off most of the old coating before putting on a new one. After the last coating has been applied, spread out the skin uncovered or hang it up to dry slowly.

When practically dry, wash off the flour paste, rinse for several minutes in water containing an ounce of borax to the gallon, then in water alone. Squeeze out most of the water. Put the skin over a beam and slick it out well on the flesh side with the back of a knife or edge of a wooden slicker (fig. 1), thus working out most of the water (fig. 7). Again tack the skin out smoothly, flesh side up, and apply a thin coating of any animal fat, fresh butter, being particu-

² Leather Trades Review, August 20, 1913, p. 596.

larly good, or a nondrying oil, such as neat's-foot, castor, or olive oil. Glycerin or a soap may be used instead of the grease or oil. If the skin originally was very greasy, it may not be necessary to apply any oil.

When nearly dry, but still slightly damp, begin to work the skin in all directions, stretching it from corner to corner and working the flesh side over a stake (fig. 1) or a wooden edge, such as the back of a chair or piece of board clamped in a vise.

The time to begin working is important and is best judged from experience. The skin must not be too wet; neither must it be too dry. The appearance of a few light spots or a light streak on folding is a good indication of the time to start working the skin.

Work the skin in all directions back and forth, as if shining shoes with a cloth. The skin may also be worked this way through smooth metal rings. Much of the success in getting a soft skin lies in this repeated working, which must be done while the skin is drying out, not after it is dry. If the skin is not soft enough when dry, it must be evenly dampened and worked again while drying. This may be repeated several times if necessary.

After softening and drying out it is well to give the skin a hasty bath in gasoline. If the skin is greasy, this must be done. This also helps to deodorize some skins, such as those of the skunk.

Finally, to clean and brighten the tanned skin, tumble or work it repeatedly in dry, warm sawdust, preferably hardwood sawdust, or bran or cornmeal. Clean these out of the fur by gentle shaking, beating, combing, and brushing.

The flesh side may be smoothed if necessary by working over a sandpaper block. This also helps to soften the skin further. If desired, the thicker sections of the skin may be made thinner and more flexible by shaving off some of the skin or hide.

SALT-ALUM TANNAGE

The salt-alum process, an old method for fur-skin tanning, is widely used. It is considered slightly better than the salt-acid tannage, being a little more permanent and, when properly carried out, giving skins which have a little more stretch and flexibility. It often happens, however, that alum-tanned skins come out stiff and hard and must be worked repeatedly and sometimes retanned.

A salt-alum tanning solution may be made up using the following proportions: 1 pound of ammonia alum or potash alum dissolved in 1 gallon of water; 4 ounces of washing soda (crystallized sodium carbonate) and 8 ounces of salt, dissolved together in one-half gallon of water. When dissolved, pour the soda-salt solution very slowly into the alum solution while stirring vigorously.

A skin, cleaned and softened as previously described, may be tanned by immersion in this solution for from 2 to 5 days, depending upon its thickness. Because of the action of alum on some furs it may be best, as a general rule, to apply the tanning liquor as a paste to the flesh side only.

Mix the tan liquor as used with sufficient flour to make a thin paste. Add the flour in small quantities with a little water and mix thoroughly to avoid lumps. Tack the skin out smoothly, flesh side up. Apply a coating of the paste about one-eighth inch thick and cover the skin. The next day scrape off most of the paste and give another

coating. Apply altogether, at intervals of a day from two to three coatings, depending upon the thickness of the skin. Only thick skins should need as many as three treatments. Leave the last coating on for 3 or 4 days. Finally scrape off and rinse clean in water, putting in about an ounce of borax to a gallon of water. Rinse at last in water only.

Work over a beam to remove most of the water. Stretch the skin out flat and sponge over the flesh side with a thin soap paste. After this has gone in, apply a thin coating of oil. Leave the skin stretched out to dry, and while it is still damp, work and stake as described on page 23, wetting and working repeatedly if necessary. Finally, clean in gasoline and sawdust and finish as described above.

SALT-ACID TANNAGE

One of the oldest processes of tanning requires various mixtures of common salt and sulfuric acid. Tanning, or, more correctly speaking, tawing, by this means is open to the objection that sulfuric acid must be used very cautiously, and must be completely neutralized to prevent later damage to the skin. Skins tanned with salt and acid also show a tendency to become damp and clammy in wet weather and, if repeatedly subjected to wetting, lose their tanned effect.

A salt-acid tanning solution may be made up in the following proportions: For each gallon of water use 1 pound of common salt and one-half ounce of concentrated sulfuric acid. Dissolve the salt and carefully pour in the acid while stirring. This tan liquor must be made and used in jars or wooden vessels, never in metal containers of any kind. (When pouring in the acid, do not inhale any more of the fumes given off than is necessary, and also be careful not to get any of the strong acid on the skin or clothing.) As soon as the acid-salt solution has cooled, it is ready for use.

Put the cleaned, softened skin in the solution so that it is entirely covered and leave it for from 1 to 3 days, depending upon its thickness. During this time stir the skin about frequently. If desired, the solution may be painted on instead. In this case, tack out the skin smoothly, flesh side up, paint over with the solution, and cover the skin with well-dampened sacking or cloth. At the end of 6 hours, paint over it again. With thicker skins, give one or two more applications of the solution about 6 hours apart, keeping the skin covered between applications. After the last application, hang up the skin or spread it, flesh side up, without cover, and let it dry.

After tanning, either by immersion or by painting, rinse the skin in clear water and squeeze out most of the water, but do not wring it. Then work the skin for about 10 minutes in a solution made up in the proportion of an ounce of borax in a gallon of water, and finally rinse well in clear water and squeeze.

Work over the skin with a slicker (fig. 1) to remove most of the water, tack it out flat, flesh side up, and apply a thin coating of grease or oil. Leave the skin stretched to dry, and while it is still damp work and stake it as described on page 23.

Finally clean in gasoline and sawdust, and finish by shaking, beating, sandpapering, brushing, and combing.